

**EFFECTS OF IMPACT VELOCITY AND STRESS  
CONCENTRATORS IN TITANIUM ON FAILURE  
BY ADIABATIC SHEARING**

Second Interim Report  
(Nov.18/2000 – Feb.17/2001)

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<b>13. ABSTRACT (Maximum 200 Words)</b> <p>This Interim Report covers the contract period from Nov.18/2000 to Feb.17/2001 (second period of three months). During this period a series of shear tests on fast servo-hydraulic testing frame with three specimen geometries have been completed. That is the following geometries of notches were applied: U-geometry, V-geometry and I-geometry. The standard geometry with a square notch was tested during the first interim period. The specimen geometries are specially design to increase the stress concentration before triggering an adiabatic shear band. The material tested was Ti-6Al-4V, delivered by the ARL-APG-AMSRL. This series of tests was limited to relatively low nominal strain rates, from 10E-3 1/s to 10E+3 1/s. Analysis of the oscillograms obtained with those tests are almost finished.</p> <p>The experimental setup for the direct impact loading has been improved and experiments are started and are continued. The range of the nominal strain rates covered by the direct impact technique is from 10E+3 1/s to ~10E+5 1/s.</p>				
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## EXTENDED ABSTRACT

During the second period (three months from Nov.18/00 to Feb. 17/01) of the Contract the program was continued as it was being planned. After the tests were completed with the fast servo-hydraulic universal machine of LPMM on all four geometries of specimen, that is Standard, U-shape, V-shape and I-shape, an exact analysis of oscillograms was continued. All tests were performed on titanium alloy Ti-6Al-4V, supplied by ARL-Aberdeen, MD. The earlier tests performed on the standard geometry, so-called Modified Double Shear (MDS), was a basis for further numerical calculations of Adiabatic Shear Bands (ASB). Improved constitutive relations had been used in those calculations, and one paper has been submitted in Jan./2001 to International Journal of Impact Engineering.

The LPMM-Metz has developed under previous contracts, partially granted by the European Research Office of the US Army, a unique experimental technique which enables impact shear testing of materials within a wide range of strain rates, the impact range covers strain rates from  $10E3$  1/s to  $\sim 10E5$  1/s, [1].

This technique has been applied to perform experiments with three geometries of specimen, that is "U", "V" and "I", with different stress concentrators. After preparation and improvements of experimental setup the experiments are already started and are continued. The main task is to find the role of stress concentrators in Ti-6Al-4V in triggering ASB.

### References

- [1] J.R.Klepaczko, An Experimental technique for Shear Testing at High and Very High Strain Rates, the Case of a Mild Steel., Int. J. Impact Engng., **15**(1994), 25.

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